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Assessing the esthetics of timber harvesting in the northern Rockies

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ASSESSING THE ESTHETICS OF TIMBER
HARVESTING IN THE NORTHERN ROCKIES

By

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Information about people's preferences for forest scenes is useful in determining management policy for public forests. This study attempted to validate a method of assessing how people liked the appearance of timber cutting units as seen from distances of about one-quarter mile to several miles. The method used photographic slides of logging methods common in the Northwest. Line drawings showing the cutting units to be evaluated were given to observers along with a ten-point response scale. Several problems were investigated. Photographs of cutting units may include other cutting units, which could affect in some nonsystematic way how people judge the cutting unit of concern. The distance of a unit, and therefore its relative scale in a photograph, may affect people's judgements. The order in which photographs are presented for evaluation may also have a confounding effect.

The study also examined whether people's educational and professional backgrounds and interests affected how they evaluated the scenes. The evaluations of two groups of college students, one Forest Service group, and staff members of a citizen interest group were compared.

The method proved to be susceptible to some of the confounding effects. Three of the four groups' ratings were affected by the surroundings of a cutting unit, and one group showed different ratings for units at different distances. The order of slide presentation did not affect the ratings. The groups showed differences in their use of the response scale; some scenes were liked or disliked to different degrees by different groups. The groups showed good agreement in overall rank orders of the scenes, from least liked to most liked. While the method was not validated, it may be useful if photographs are chosen carefully to minimize differences in surroundings and in scale.

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Chapter 1

INTRODUCTION

The Forest Service of the U.S. Department of Agriculture is required to manage the National Forests for a variety of uses which are not always compatible. The Multiple-Use Sustained-Yield Act requires that the "relative values of the various resources in particular areas" be given due consideration in deciding how public forest land is to be managed (Multiple-Use Sustained -Yield Act, 1960). Consideration of a resource implies assessment of its nature, extent, value, and changes in its use by society. Insufficient or incorrect information on any forest resource thwarts proper planning for its conservation and use.

Scenic beauty is a resource which can be used without being diminished. Timber cutting, roadbuilding, or other development of the forest may change or destroy the scenic resource. Since Forest Service regulations require that the visual resource be considered equally with the other resources of the land (U.S.D.A. Forest Service, 1974a), it follows that scenery should be evaluated before committing forest land to uses which could reduce its attractiveness. An evaluation should include both an assessment of the value of scenic beauty and of the possible changes in value or attractiveness due to development activities.

This study is concerned with developing a method of assessing public preferences for forest scenes in the Northern Rockies. The study focuses on timber cutting on National Forest land, where the managing agency must attempt to reconcile a host of competing land uses, among them viewing scenery, on a fixed land base. The National Forests are also managed according to the National Environmental Policy Act, which requires all Federal agencies to "improve and coordinate Federal plans, functions, programs and resources to the end that the Nation may assure for all Americans...safe, healthful, productive and esthetically and culturally pleasing surroundings" (National Environmental Policy Act, 1969).

A forest is a complex, dynamic system which responds to human intervention in many ways. Resource development may have little effect on scenic beauty, or it may have severe and long-lasting effects. In evaluating scenic resources it is necessary to understand the degree to which resource development changes the attractiveness of a forest. It is necessary to predict both the magnitude and direction of changes in appearance. With adequate measurement and description of the expected changes following logging, for example, it will be possible to select the least visually disruptive management technique which will meet silvicultural goals. It will also be possible to decide whether, in particular instances, any timber harvesting or road construction is desirable in the light of probable losses in scenic quality. Development of an adequate method of scenic beauty analysis, and a method to predict changes resulting from management activities, would allow the esthetic resource to be placed on an equal footing with other forest resources. Without this analysis, the possibility remains that scenic quality will not be fully considered in making management decisions.

Of the various resource management activities carried out on National Forest land, timber harvesting and associated road construction is probably the most noticeable to most observers. In areas where timber production has priority over preservation or non-development uses, it is desirable to design sales which have a minimum visual impact, or which possibly enhance the view. On lands devoted to non-timber uses, it is still vital to know if sales can be designed which meet the overriding goal of retaining the attractiveness of a landscape. Finally, some lands may be managed for a balanced mix of timber and nontimber uses. In these areas, visual resource information can be used to determine the impact of timber cutting on other land uses.

Statement of Problem

The goal of evaluating esthetic preferences for timber cutting is to be able to design cutting units which have a minimum adverse effect on scenic beauty, or if possible, a positive effect. To do this, it is desirable to to predict the impact of timber sale designs on forest esthetics by studying existing cutting units, and making inferences about the effect they have on people's preferences. Before this can be done, a reliable method must be devised for collecting and evaluating people's preferences for forest scenes. Such a method should be free from confounding effects such as would occur if extraneous elements of a forest scene, such as roads or other cutting units, influence people's preferences more than the unit being considered.

This study attempted to develop a method free from unwanted confounding effects which could not be controlled in such a way as to give useful information. Since a forest scene must be considered as a whole, and a single cutting unit cannot be viewed in complete independence from the surrounding landscape, the task of developing a completely reliable method is difficult. For this reason, forest scenes which contained highly noticeable man-made features other than the cutting unit under consideration were used. A preference evaluation method must be reasonably free from the uncontrolled influence of these features if such surroundings are to be included in photographs of cutting units being evaluated. If a method is not free from a surroundings effect, the cutting units must be photographed or otherwise represented so that the surroundings are as uniform as possible.

A second goal of esthetic preference assessment is to determine if and how people from different backgrounds and interests differ in their expressions of preference for scenes. This study investigated the differences between the expressed preferences of several different groups of people.

Finally, in this paper the methods of evaluating forest scenes now in use are evaluated. The applicability of these methods to the evaluation of timber cutting in the Northern Rockies is considered.

Chapter 2

MEASUREMENT TECHNIQUES

The land manager can use several kinds of methods to evaluate or inventory forest landscapes. This chapter describes some of the methods which have been developed and will evaluate the strengths and weaknesses of each for evaluating the esthetics of timber cutting.

Three broad categories of landscape assessments, descriptive, evaluative, and preferential, have been identified by Craik (1972). A "descriptive assessment" identifies characteristics of landscapes without evaluating their relative or absolute worth. One such method, developed by Litton (1968), examines "factors of recognition" which depend on the characteristics of the landscape. Combinations of these factors and various observer positions give six "compositional units" which express specific relationships between observer and scene. For example, a "focal landscape" most often is a view of a streamcourse or valley which tends to direct the observer's attention to a single locus of a scene.

Litton's approach integrates the physical features of a landscape with the position of the observer. Thus a single landscape may present different compositional types to observers located in a valley, on a hillside, or on the top of a mountain.

Descriptive assessments have the advantage of great flexibility and range of application. They may be used to examine large areas of land or focus on small areas. A single person may conduct the inventory, or a more detailed inventory may be done by a team.

A descriptive assessment can be designed to express perceptions common to people of different backgrounds. Craik (1972) has shown that different groups of well -educated observers show substantial agreement on the application of Litton's descriptive criteria to photographs of landscapes. These observers included students and faculty in the fields of forestry and landscape architecture, Forest Service personnel, university students from diverse fields, and students in a college conservation course (Craik, 1972).

A purely descriptive inventory does not predict the result of man-induced changes of a forest scene. A description of a landscape can serve as a benchmark for comparison with later inventories, in order to measure changes in a landscape. Description alone, however, does not offer guidance in planning timber sales or other forest projects.

The second of Craik's classifications, "evaluative appraisal", is a description of landscape quality according to whether a scene meets a stated criterion.

This approach has been used by Litton (1972) to propose three esthetic quality criteria: unity, vividness, and variety. These may be thought of as acting together, in a conjoint manner, to form an objective level of scenic quality. Litton's landscape dimensions probably do not account for all of what one sees in a forest scene. The three adjectives have little metric value, and cannot easily be measured objectively. They bear no direct relationship to Litton's definitions of recognition factors or compositional types. The three esthetic criteria may be useful as broad generalizations with which one may distinguish between different landscapes.

The U.S. Forest Service has broadened Litton's landscape inventory method to provide guidance in making management decisions (U.S.D.A. Forest Service, 1972). Their "visual management system" classifies landscapes, estimates their sensitivity to public reaction if disturbed, and prescribes "quality objectives" for timber cutting and roadbuilding.

The Forest Service system classifies landscapes according to "variety", with precisely worded but arbitrary distinguishing criteria. For example, a landform with "common" variety would have thirty to sixty percent slopes which are moderately dissected or rolling, as well as other defined characteristics. Criteria for variety classes are given for landforms, rockforms, vegetation, lakes, and streams. The Forest Service system also examines the potential for landscape alterations to be seen by the public. Depending on what proportion of forest visitors are likely to see a particular scene, it is given a "sensitivity level" of low, average, or high.

Variety class and sensitivity level information directly influences subsequent management guidelines. Different visual quality objectives are listed for each combination of variety class and sensitivity level (U.S.D.A. Forest Service, 1974b). For example, a "background" landscape with an average sensitivity level could have one of three visual management objectives, depending on its variety classification. The objectives, in turn, limit the degree of permissible changes in line, form, texture and other elements due to resource development. A "distinctive" variety landscape, in this example, would have the objective of partial retention of the landscape character. A landscape having "common" variety would receive a "modification" objective, and a landscape having minimal variety would be open to maximum modification of its visual character.

The approach used by the Forest Service has several advantages. As noted above, large areas of land can be inventoried, using map overlays and aerial photographs to replace much of the fieldwork. The forest land can be stratified into units of any size having different visual management objectives. The method also integrates landscape dimensions with assumed public desires.

The Forest Service approach also has several disadvantages. No direct measurement of public preference is ordinarily taken. A scene viewed by a forester may be perceived or responded to much differently by lay citizens. Some people may strongly dislike highly visible timber cutting, while others, perhaps dependent on forest industries for employment, may accept or even express liking for the same scene.

The Forest Service's visual management system could be strengthened by obtaining preference information from forest users and other interested people. This would involve the use of preferential judgements, the third of Craik's landscape assessment techniques. Preferential judgements are subjective evaluations of a landscape without analysis of the landscape's components or features (Craik, 1972).

Preference information can be used to determine what components or features of a landscape are recognized by observers. Work in this area has used multidimensional scaling techniques (Coombs, 1964) to explain observer judgements of similarity and preference in terms of perceived landscape attributes (Touzeau, unpublished thesis). Factor analysis (Harman, 1960) has also been used to discover what elements of a scene may correlate with preference judgements. Shafer, Hamilton, and Schmidt (1969) have used photographs of forest scenes to relate landscape and vegetation features to preference information expressed as rank ordering of the photographs by observers. A linear regression equation using ten terms explained sixty-six percent of the variation in landscape preferences. The observers were sampled from recreational campers in the Adirondack mountains, and the photographs represented scenes typically viewed by such campers.

This approach is useful as a predictive model of public preferences; however, the features identified by Shafer, Hamilton, and Schmidt do not lend themselves to experimental control by the land manager. Factors such as the visible perimeter of sky, water, or vegetation used in this study will change with the position from which photographs are taken. These factors, furthermore, are difficult to relate to the design of timber sales or to the layout of roads.

A perceptual preference assessment would be most useful to the land manager if it gave information on which project designs would have the least adverse visual impact. Such a system would be most useful if it represented all people with an interest in the esthetics of a forest, and if it were sensitive to their relative intensities of preference for scenic quality. The method would also have to be fairly simple to administer and apply.

Verbal polls or opinion surveys, if properly designed, can reach a representative sample of people. They can also be worded so as to evaluate intensities of preference for alternative management methods. The main drawback to polls and questionnaires is that the respondents react to words and not to actual forest scenes. The way in which different forest practices are described may influence people's responses. A logging unit can be described as a clearcut, patch cut, regeneration harvest, or scenic vista point, with equal validity but very different subjective responses.

Public opinion can also be assessed by passive means. These could include public listening sessions, advisory groups, or simply waiting for the public to make its views known to the land manager. An active solicitation of comments and ideas may produce useful information, but if it is to be useful in improving management practices, the comments must be specific and identify the source of the problem. A statement that "clearcutting looks ugly" is of little use to the forester who must design timber sales which are esthetically acceptable. Such a comment offers the land manager the choice of not clearcutting at all, which may not solve the problem if alternative cutting methods do not look any better. The manager needs to know what it is about a cutting method that people dislike. It may not be possible for the casual observer to determine which elements of a cutting unit are responsible for the objectionable appearance of the unit.

The public-reaction approach to landscape preference assessment also disenfranchises many people who may not be familiar with the forest land in question, or who may not be aware of proposed management plans. People who do not live close to National Forests still have a legitimate interest in forest practices, both in how it affects their livelihood and in how it influences their sense of esthetic quality. It is necessary to represent the interests of people who are not familiar with forest management issues and problems. This may be possible if common bases of perception can be found through preference assessment.

The perceptual preference assessment methods described above have advantages which should not be overlooked. Some combination of several methods will yield useful information for decision making. The approaches mentioned previously have one of two difficulties: they inadequately represent forest landscapes to observers, or else query an insufficient number and variety of people.

Metric Methods

Metric preference assessment methods use the judgements of a number of observers to evaluate preferences for scenes. This approach can allow adequate representation of scenes by using photographs, and it makes it possible to assess the preferences of large numbers of observers.

The kind of preference assessment method which has been used most often to evaluate forest scenes is the category scale. This method limits the observer to one choice among a series of alternatives such as numbers or words (Jones, 1974). It gives an ordinal measure of preference, since the choices are arrayed in increasing or decreasing degrees of preference. There can also be an expressed or implied metric relationship, such as equal intervals or ratios, between the choices in a category scale.

An ordinal scale does not measure absolute levels of preference, nor does it show whether there are large or small differences between choices. Even the use of category scales which have equal ratios or intervals between choices cannot establish the absolute level of various preference judgements. This is due to the limited number of choices available to the observer. A category scale is often limited to ten or fewer alternative choices because of an observer's limited ability to discriminate between a large number of levels in a response scale (Jones, 1974).

Non-category Metric Methods

Some experimenters in psychophysics have used non-category scales. Some of these methods allow the observer to place a value on each stimulus (it is often the level of a stimulus and not the degree of preference which is being judged) with an expressed or implied metric relationship between responses. For example, the observer may be asked to associate any positive number with a stimulus, so that the relationship between the chosen numbers corresponds to the subjective relationships between sensations. This approach has been used extensively by Stevens (1975), who calls it the method of magnitude estimation.

An alternative non-category judgement method allows observers to select stimuli to correspond to numbers or to numerical relationships. For example, the observer may be asked to set a tone so that it is twice as loud as a reference tone. This yields ratio scales (Stevens, 1975) which correspond to some degree with actual ratios of the stimulus values. Partition scales, a variation of this approach, resemble the category rating method. Observers are asked to select stimuli which are equally spaced in loudness, pitch, or other subjective value, usually within the bounds of upper and lower reference stimuli. This differs from a category scale in that the observer, not the experimenter, selects the stimuli.

For the purpose of evaluating forest scenes, an approach in which the experimenter selects the stimuli is best. Views of landscapes are hard to manipulate in any one dimension, let alone the many dimensions which likely affect esthetic judgements. The investigator needs to use a method which obtains the judgements of a fixed set of scenes selected in advance. This narrows the choice to methods which use some sort of a response scale.

Comparison of Methods

The various metric preference assessment methods which use preselected stimuli and a response scale each have advantages and disadvantages. Magnitude estimation, in the manner used by Stevens (1975), need not constrain the observer to a given set of responses, so they can express intensities of preference at will. A reference scene can be given values such as ten or one hundred, in order to place all of the observers at a common starting point. Alternatively, reference scenes and numbers can be dispensed with, and the numerical judgements can be mathematically normalized or standardized to reduce the idiosyncratic use of numbers.

The ability of magnitude estimation to detect intensity of preference also leaves it open to bias by pernicious observers. An observer who wants to affect the outcome of a study can select extremely high or low numbers for certain scenes, and have a disproportionate effect on the ratings. Normalizing or standardizing the scores cannot easily eliminate this effect. The observers can be screened to possibly eliminate those who would have a stake in the outcome of a study, but individual selection of observers is difficult, time-consuming, and reduces the representativeness of the sample. Individual responses which appear to be greatly biased can be discarded, but this is prone to experimenter bias.

Another difficulty with magnitude estimation and other absolute judgement methods is that esthetic quality or preference does not lend itself to direct measurement in the way one can measure mass, size, or color. Experiments using absolute judgements have uncovered well -ordered relationships between physical stimuli and sensations, but these relationships, such as Stevens' power function (Stevens, 1975) cannot easily be obtained when the stimulus is as hard to measure as esthetic quality. Some of the value of absolute judgement methods is lost when applied to measuring preferences for scenes.

Rank order or forced choice methods lose all metric information beyond simple ordinal measurement (Green, Carmone, and Wind, 1972). Even ordinal information, however, can be useful in deciding what kinds of forest scenes or logging methods are preferred over others. Given that esthetic value is hard to measure in any objective, predictable manner, ordinal information may be as close as one can get to measuring scenic beauty. Obtaining reliable rank orders from large numbers of scenes requires the use of photographs, drawings, or other easily manipulated representations of the scenes. A great number of scenes, seen from different locations, cannot be compared with each other in the field. Even using photographs, an observer is limited in the number of scenes which can be compared at one time. By separating photographs into categories of preference, then sorting within and between categories, a larger number of scenes can be evaluated (Green, Carmone, and Wind, 1972). This is a fairly complicated procedure, but it does allow more information to be obtained from each observer.

Numerical or verbal category scales remain as a possible preference assessment method. Numbers are more easily transformed as data than words; the latter often need to be transformed into numbers for analysis. Each numerical category can be verbally described with an adjective such as "beautiful", "unattractive", "like", "dislike", and so on. Reference scenes can also be used for each category, or to anchor the midpoint of the scale. This has the difficulty of determining in advance what is attractive or unattractive: the use of reference scenes presupposes what looks good or bad and may not correspond with the way observers see things.

Category scales give ordinal information only, but they provide this information more quickly than rank order methods. It is debatable whether the category or rank order method is more accurate in ordering preferences for scenes. Use of a category scale assumes that observers are consistent in their use of numbers throughout the observation session. That assumption remains to be tested.

Observer Agreement

If agreement can be found between people of widely varying interests on what constitutes attractive and unattractive scenes, even something as hard to measure as esthetics would gain some objective value. It is important to measure how different people react to scenes as well as to examine various measurement methods. Boster and Daniel (1976) have examined this question with on-site evaluations (by photography or direct viewing) of timber cutting in the Southwest. Their research showed substantial agreement of transformed metric ratings of forest scenes among foresters, environmentalists, students, economists, and members of a Catholic Church group. The statistics representing each group's scenic beauty evaluation were transformed raw scores designed to eliminate the observers' idiosyncratic use of the response scale.

Zube (1975) found similar use of semantic differential scales and rank ordering of scenic quality for photographs of landscapes among different professional groups. The two groups tested were environmental designers (technicians and researchers) and resource managers. Zube did find differences between the two groups in their use of free written descriptions of the scenes. The resource managers tended to describe objects in the photographs, while the environmental designers concentrated on describing the spatial distribution of objects. Despite the different perceptions of the scenes, the two groups made similar evaluations of their scenic quality.

Observer Position

Timber cutting units may be seen from close at hand or from a distance; the observer may be above, level with, or below the observed scene. The position of the observer will determine how much of the visual field is subtended by the cutting unit, and how much detail is visible in the unit and in the surrounding forest. This will affect the appearance, and therefore the degree of liking, of the cutting unit. For example, a large clearcut on a low relief slope may be fully visible to an observer on a hillside above the unit, while the same unit may be entirely screened from view to a person level with the unit. Since this study is concerned with the effect of timber sale design, not observer position, on scenic beauty, it is desirable to hold constant or account for the effect of observer position on preference judgements.

The photographs used in this study to represent forest landscapes were taken from positions nearly level with the cutting units depicted. Variations from a level position are less than about ten degrees, and for the purposes of this study are assumed not to have a significant effect on preference judgements.

The distance of an observer to a cutting unit may have a much more significant effect on esthetic preferences because the range of variation in distance is great. Much of the topography of the northern Rockies is steep, with slopes supporting commercial timber stands often exceeding fifty percent relief. Timber cutting on steep slopes will be visible to distant observers if their view is not blocked by vegetation or intervening hills. Timber cutting is also visible from close at hand, as the observer travels through or alongside a cutting unit. The observer, therefore, may be within or next to the unit (on site), or else viewing it from outside the unit (offsite). Offsite views may be as close as a few hundred yards across a narrow valley, or as distant as many miles, limited by the clarity of the atmosphere. In this study the offsite views will also be termed far views.

On-site views in the northern Rockies have been studied using direct assessment of public preferences. Ullrich, Ullrich, Schweitzer, Touzeau and Braunstein (1975) have used photographs taken within cutting units on the Coram Experimental Forest in Montana, while Benson

(1974) has made similar studies on the Teton National Forest in Wyoming. The only perceptual preference study to date using off site photographs (Schweitzer, Ullrich, and Benson, 1976) used a small number of cutting units in the Coram Experimental Forest. The far views data collected in this study were inconclusive, and the method used to obtain preference judgements has not been shown to be free of confounding effects.

People view timber cutting in the northern Rockies from towns, while traveling through the forest, and from travel routes outside the forest. A large class of forest scenes, therefore, has been only minimally studied using perceptual preference techniques.

Chapter 3

EXPERIMENTAL METHOD

Purpose

The purpose of this experiment was to determine the validity of one method of assessing scenic beauty. The experiment was not designed to give useful information about the effect of timber sale designs on the attractiveness of scenes. Instead, the experiment examined possible confounding effects which would interfere with the assessment of scenic beauty. These effects included the presence of human activities in the foreground of the scenes, the order in which the scenes were shown to observers, and the distance of the cutting units from the photographer. The experiment also examined possible differences in preferences shown by observers of varying educational backgrounds and professional interests.

Representation of Forest Scenes

Color slide photographs of thirty-seven different forest scenes were shown to four separate groups of observers. The experimenter made the photographs with thirty-five millimeter cameras using fifty and forty-two millimeter lenses; they were taken in National Forests in western Montana, Oregon, and Washington. Forty-eight slides altogether were shown, and a number of the scenes were shown twice. In an effort to minimize unwanted effects not subject to experimental control, the photographs were selected to meet several criteria:

- they were of good technical quality, normally exposed and composed, and without obvious marks on the film;
- they were taken in full or near full sunlight, in late morning or early afternoon, to avoid long shadows;
- they clearly showed the cutting units at distances of about one-quarter mile to several miles.

In addition, a wide variety of cutting units were sampled, along with a few scenes of natural meadows, pine savannas, and a fire burn, all of which resembled old logging areas. The cutting units were designs common in the Northwest, and included clearcut, shelterwood, selection, and commercial thinning methods. The forest types in the photographs are commonly found in the Northwest, and included Douglas fir (*Pseudotsuga menziesii*), Western Yellow pine (*Pinus ponderosa*), and Lodgepole pine (*Pinus contorta*), plus associated species. Appendix A gives the locations of the scenes used in the experiment.

Experimental Design

Three separate questions were examined using the data gathered from the four groups of observers. Of the forty-eight slides shown to each group, the first twelve were included to accustom the observers to the use of the response scale (see Figure 1). The last twelve slides were

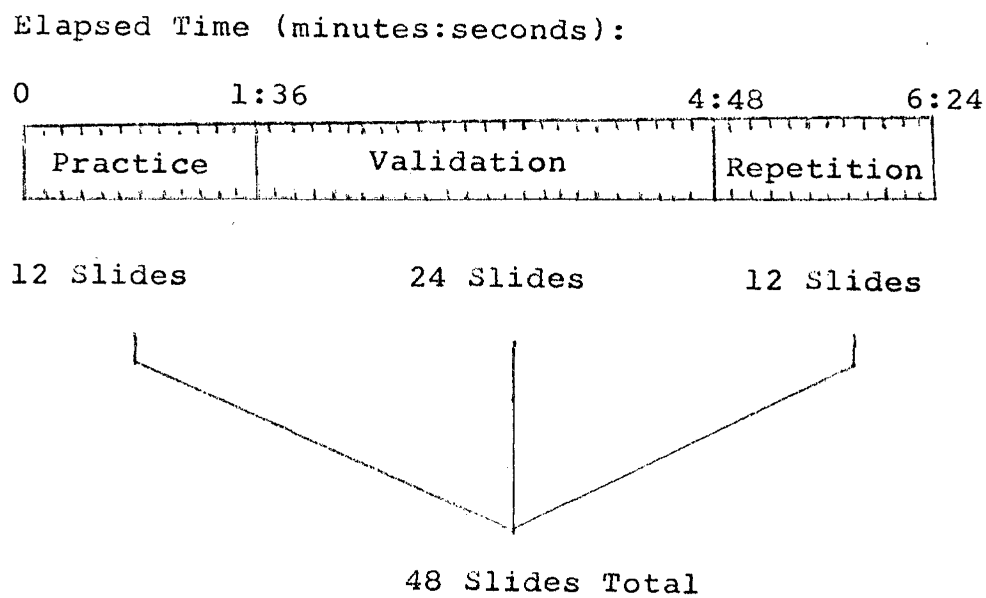


Figure 1

Slide Presentation

included to test differences in observers' ratings when compared with the initial twelve slides. The middle twenty-four slides comprised a validation study, which tested for possible confounding effects of several experimental variables. Ratings of all forty-eight slides were used to test for differences in preferences between groups. Ratings of an additional selection of fifteen slides were used to test for intergroup differences.

Validation Study

The middle twenty-four slides included twelve forest scenes photographed in pairs. Each scene was photographed from the same location, but at two slightly different camera angles. The lower-angle photograph showed a cutting unit along with a very evident human activity in the foreground, such as a road, another logging unit, or a grazed meadow. The higher-angle photograph showed the same "target" unit without the developed foreground. More of the forested hillside or more sky was included in the foreground-absent photograph. It was hypothesized that the inclusion of the developed foreground had no effect on the preference ratings of the cutting units.

The slides used in the validation study also varied on a second dimension, the distance from the camera to the cutting unit. The slides fell into two categories: those with the cutting unit at distances of less than about one-half mile, and those showing the target unit at distances greater than about one mile. It was hypothesized that the distance of the cutting unit from the photographer had no significant effect on the ratings of the units.

The fact that some slides had been seen before in the experiment could affect people's ratings. To test for this, half of the cutting units were shown first with evident foregrounds, and half were shown first without visible foregrounds. This allowed a test of a third hypothesis: the rating of a cutting unit did not vary significantly between the first and second showing of a similar slide showing the same unit.

A fourth hypothesis concerned a possible interaction between two of the factors. While the above hypotheses predict no significant effect of either distance or foreground alone, the two factors may interact to produce a significant effect. For example, a more distant view of a cutting unit may be dominated by a developed foreground. It was hypothesized that any effect of foreground on preference ratings would be strengthened in distant views. Since the effect of foreground alone is not known, the direction of the interaction cannot be anticipated.

The three dimensions or factors in the validation study were arranged in a 2x2x2 factorial design, with three replications of each condition, for a total of twenty-four slides presented to the observers.

Repetition Effect Study

The first and last twelve slides in the experiment made up the repetition effect study, which tested the effect on preference ratings of repeating some of the slides. Identical copies of slides were shown in this study, unlike the validation study where photographs of the same cutting unit taken at two camera angles were used. Ten copies of slides included in the first twelve slides were shown in the final block of twelve slides. Two scenes in both the first and last blocks were different from each other. The two slides were scenes of uncut, undisturbed forest and meadow areas. They were not repeated because their distinctive nature (being a minority among slides of developed areas) could allow observers to recall their previous ratings more easily. It was felt that the greater number and rapid presentation of the slides of the cutting units would preclude observers from remembering their previous ratings.

An additional purpose of showing the first twelve slides was to accustom the observers to the esthetic judgement task. Instead of verbally describing the scenes which would be shown, or showing examples of the slides, it was felt that the first block of twelve slides would be sufficient for the observers to establish criteria for the use of the response scale.

Intergroup Differences Study

The third study attempted to determine if there were any differences in preference ratings between the four groups. All forty-eight slides were used for one test of intergroup differences using an analysis of variance. The maximum number of slides were used in order to obtain the most power. Another test of intergroup differences used only non-repeated slides which did not have developed foregrounds. A total of fifteen slides met these criteria and were used in this test.

Data Collection Method

Four groups of observers viewed the slides in five separate experimental sessions. The first group consisted of sixteen U.S. Forest Service employees on the Lolo National Forest in Montana. Members of this group were college educated in forestry, with backgrounds in silviculture, forest engineering, landscape architecture, and forest administration. This group viewed the slides in two sessions: one session of six observers at the Missoula Ranger Station, and one session of ten observers at the Ninemile Ranger Station.

The second group were eighteen undergraduate students in an introductory psychology course at the University of Montana. The third group of seventeen observers were staff workers for Bikecentennial, a non-profit citizen group which promotes bicycle touring. Members of this group were mostly college educated people under the age of thirty-five. The fourth group of twenty observers were undergraduate and graduate students in a natural resources law course at the University of Montana. Members of this group were primarily majors in forestry, wildlife biology, and business administration. They differed both in average age and in academic majors from the psychology student group.

For purposes of identification, the four groups of observers are referred to as the Forest Service, psychology, Bikecentennial, and law class groups. Data collected from the groups were given computer file names of USFS, PSYCH, BIKE, and NRLAW, respectively.

Each group reviewed the slides in separate experimental sessions designed to be as uniform as possible. It was necessary for the experimenter to travel to the classrooms or offices where the observers were located, so it was not possible to precisely standardize the experimental settings.

The slides were shown in darkened rooms with only enough light coming through windows to enable the observers to see the response sheets. Observers sat close enough to the screen to be able to see all or most of the detail in the photographs with normal vision. The observers were positioned as close as possible to the axis of the slide projector, without interfering with each observer's clear view of the screen. Once the observers were seated and response forms were distributed, the experimenter read a set of standardized instructions to the group. Questions for purposes of clarification only were answered. The slide projector was turned on to a blank position, and the forty-eight slides were shown at eight second intervals, using an automatic timer. The experimenter called out each slide's number so the observers could locate the corresponding drawing and response scale.

Each observer viewed each slide and rated it on a zero-to-nine scale according to their degree of liking or disliking of the cutting unit shown in the slide. To focus the observers' attention on the target cutting unit, line drawings of each slide were included above each slide's rating scale. Appendix C shows a reduced page from the six page response form. The line drawings show the target cutting unit enclosed in a bold, dotted box.

After the session, the observers returned the response forms to the experimenter, who then gave a brief outline about the nature and purpose of the experiment, and answered further questions. Data from the response sheets were transferred to punch cards and were analysed by computer.

Chapter 4

RESULTS

Validation Study

The middle twenty-four slides in the experiment, as mentioned previously, form a 2x2x2 factorial design with three replications of the eight-cell matrix. Preference ratings using the zero-to-nine integer scale were summed across three replications, giving a mean rating for each cell which could vary from zero to twenty-seven. An analysis of variance (RBF-222, Kirk, 1968) was performed to test for differences arising from the main effects of the three dimensions, and from interactions between the dimensions. One analysis of variance was performed for each of the four groups. Only data from those observers who completely and unambiguously filled out the response forms were used. The numbers of observers given for each group includes only those whose responses were used.

Table 1 shows the results of each of the analyses of variance. Of the main effects, distance was significant (alpha equals 0.05 for all tests) for the law class. The foreground dimension was significant for the Forest Service, Bikecentennial, and law class groups.

The law class preferred the more distant views of the

Table 1

Validation Study: F Ratios

	Groups			
	USFS	PSYCH	BIKE	NRLAW
	df= 15	df= 17	df= 16	df= 19
Distance	0.199	3.139	1.325	5.119*
Foreground . . .	6.901*	0.604	33.858***	12.55**
Order	4.116	0.261	0.866	0.497
D X F	2.524	2.693	19.725***	1.751
D X O	0.051	0.991	1.004	7.395*
F X O	4.091	1.345	1.003	7.410*
D X F X O . . .	19.138***	3.217	1.929	1.437

Significance Levels: * denotes p less than 0.05

** denotes p less than 0.01

*** denotes p less than 0.001

cutting units (see Table 2), while three of the four groups preferred the scenes without developed foregrounds.

Interactions Between Factors

The Bikecentennial group showed an interaction between the distance and foreground factors. Of the foreground -absent slides, this group preferred the distant views (see Figure 2), while close views were preferred in the foreground-absent slides. It was hypothesized that distant views would tend to increase the relative effect of developed foregrounds. The data from all four groups tend to confirm this hypothesis. Bikecentennial showed a net difference of 2.48 rating points (summed across three replications) between the close and distant foreground -absent and foreground-present conditions. The other three groups also showed (although not to a statistically significant degree) greater dislike of the foreground -present condition in the distant slides than in the close slides.

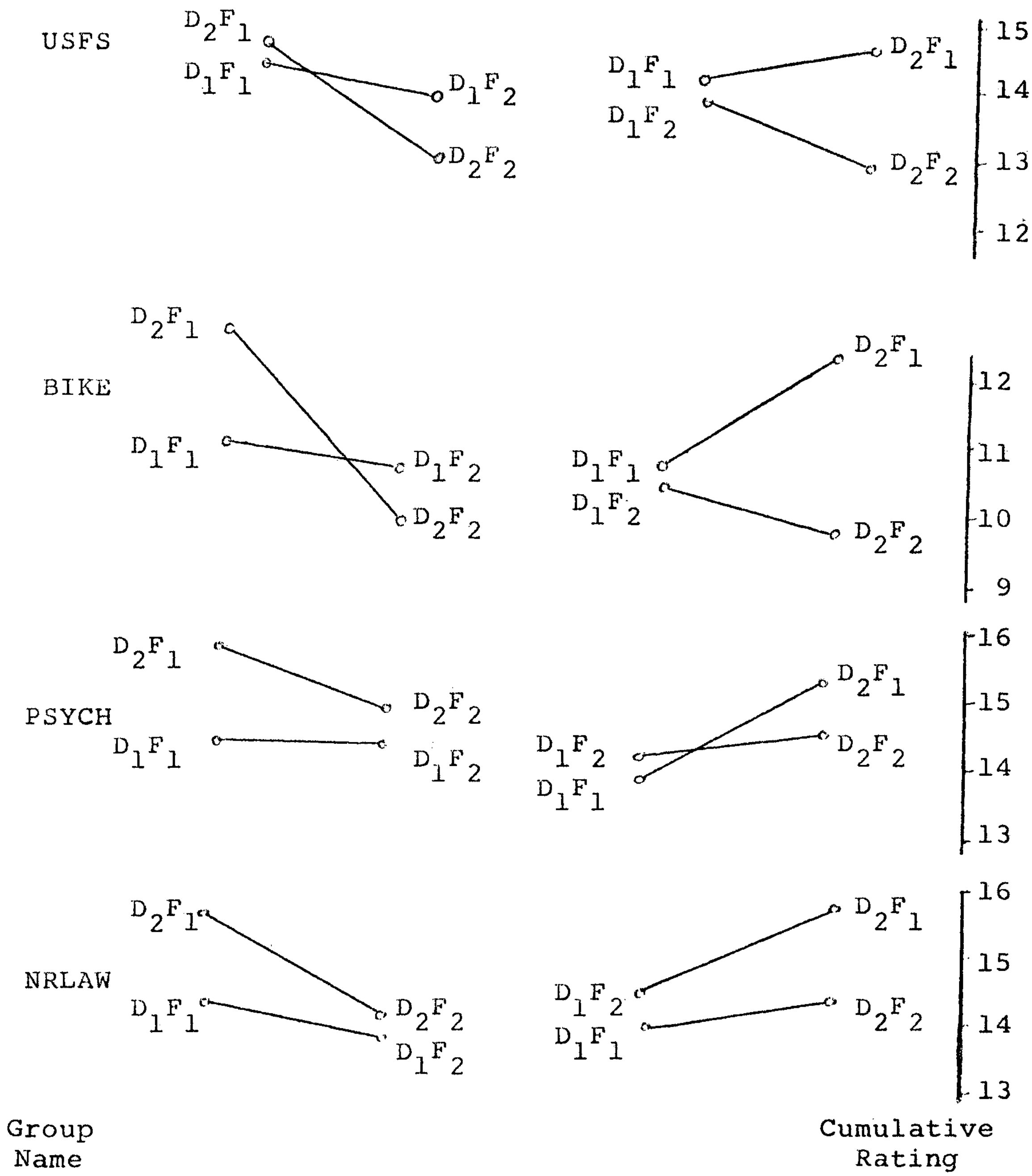
Several other interactions were statistically significant, but were not predicted by the experimental hypotheses. The first, distance-order, was significant for the law class. These observers preferred the more distant views of those presented first (see Figure 3), but only slightly preferred the close views of those presented second. Since there was no known systematic effect of order of slide presentation on preference ratings, there is no

Table 2

Validation Study: Cell Means

		Close		Distant	
		absent	present	absent	present
USFS	2nd	14.50	15.25	17.13	12.06
	1st	14.88	13.44	13.19	14.81
BIKE	2nd	9.82	9.65	12.41	8.65
	1st	9.71	9.18	10.41	8.71
PSYCH	2nd	13.72	14.17	15.61	13.72
	1st	13.89	13.78	14.94	15.39
NRLAW	2nd	15.20	13.50	16.05	12.40
	1st	13.40	14.15	15.05	15.90

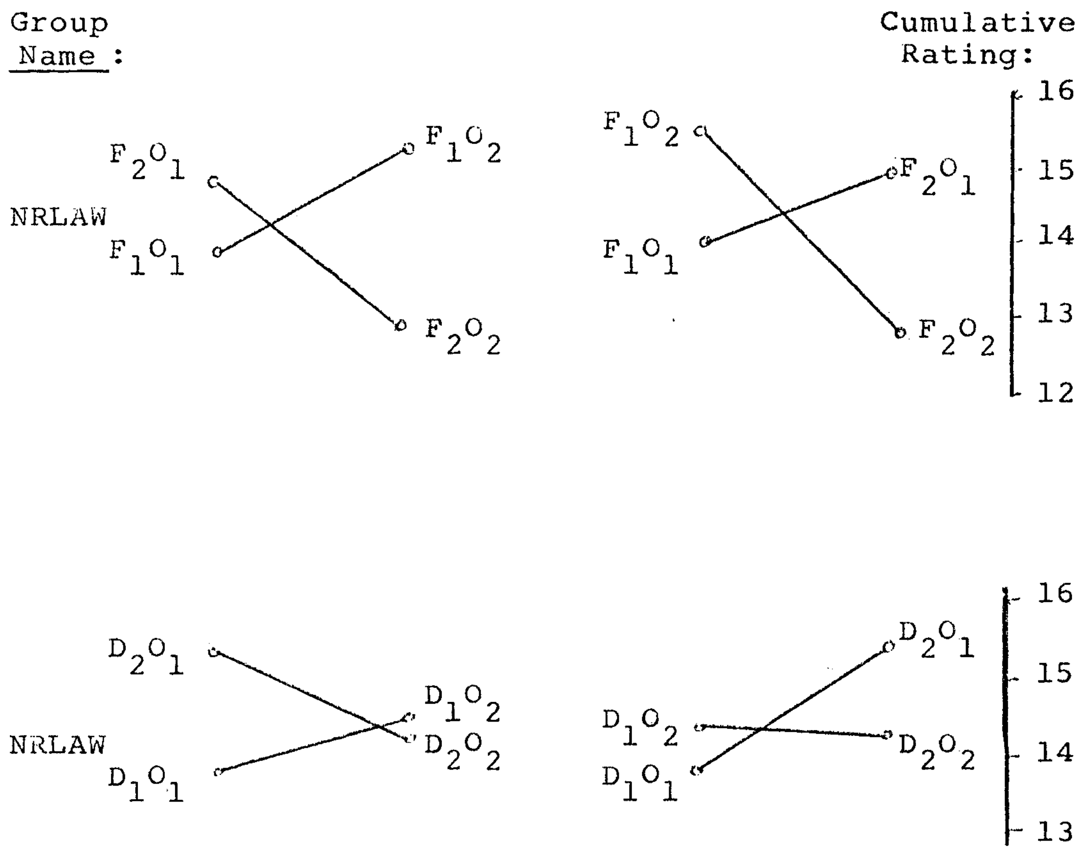
(All cell values are summed across three replications)



D_1= close
D_2= distant
F_1= absent foreground
F_2= present foreground

Figure 2

Distance X Foreground Interactions



D_1= close　　O_1= first　　F_1= absent foreground

D_2= distant　　O_2= second　　F_2= present foreground

Figure 3

Foreground X Order and

Distance X Order

Interactions

way to be sure why this interaction took place. The two factors are physical (distance) and artificial (order), unlike the interaction of two physical dimensions such as distance and foreground. The lack of significant interactions between distance and order in the other three groups argues against a causative agent which affected all of the groups.

The law class also showed an interaction between the foreground and order factors. As with the distance-order interaction, the two interacting dimensions are physical and artificial, which makes it difficult to explain the nature of the interaction. The lack of a significant main effect for the order dimension alone makes it hard to determine what effect order might have in interactions with other dimensions.

An interaction between all three dimensions (see Figure 4) was shown by the Forest Service group. None of the other groups showed the same relationships between each of the eight combinations of the dimensions, although the number of possible combinations of the dimensions makes this unlikely. Of the thirty-six combinations among the three other groups, twenty-six were similar in direction (but not in magnitude) to the Forest Service group. This shows some consistency among the non-significant interactions, but this does not suggest a plausible explanation for the Forest Service group's interaction.

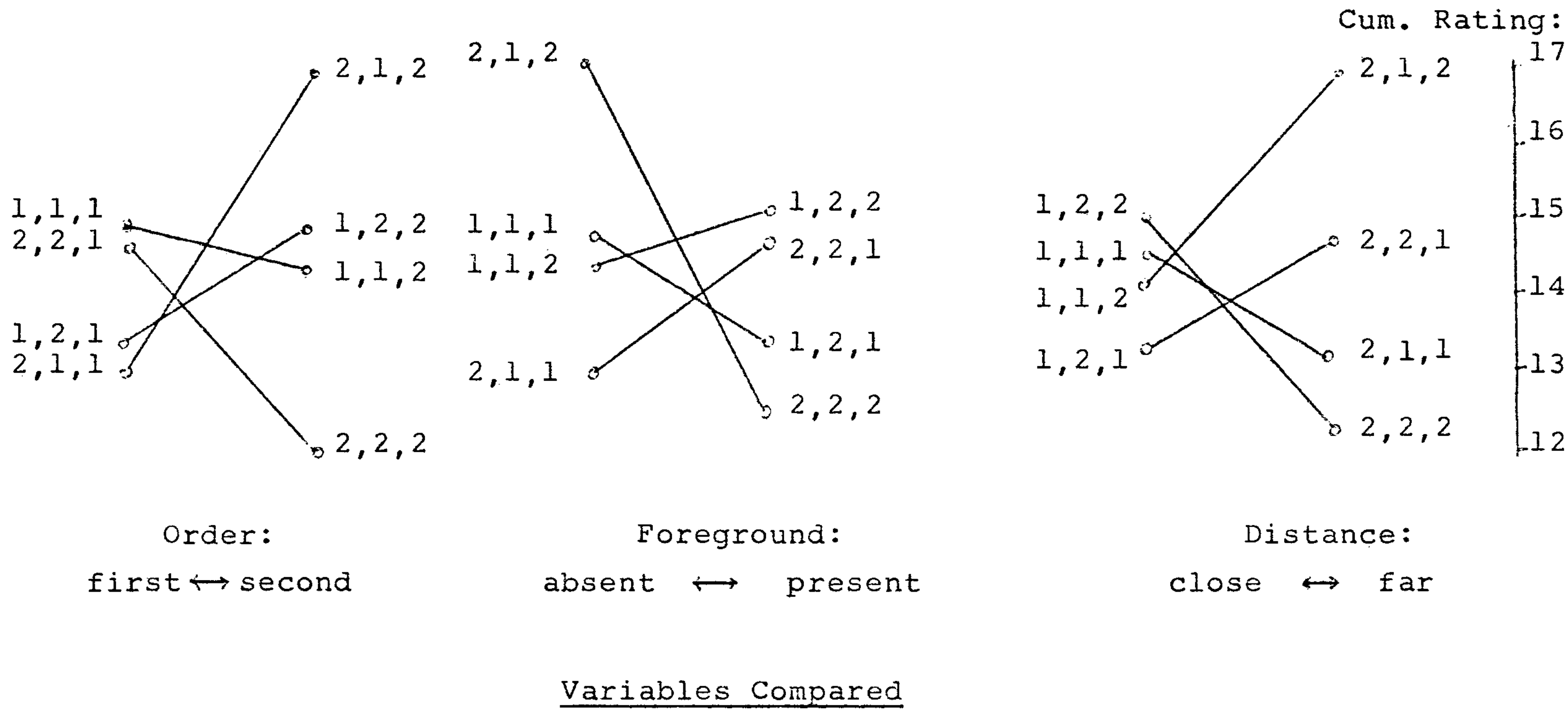


Figure 4

Distance X Foreground X Order
Interaction, USFS Group

Group Differences

Several statistical tests were made to detect differences between each of the groups' preference ratings. An analysis of variance (SPF 4.36, Kirk, 1968) was performed for a factorial design of four groups of observers and thirty-six slides. The first twelve slides in the experiment were disregarded as practice slides. The purpose of the test was to see if the groups showed significant differences in their mean ratings of each slide. To simplify the analysis, each group was limited to equal numbers of observers. This number was equal to the smallest group size, sixteen. The other groups were reduced to this size by disregarding the responses of one, two, and four observers from the Bikecentennial, psychology, and law class groups, respectively. The disregarded observers were those who showed the narrowest use of the response scale, that is, those whose scores had the smallest range. It was felt that the power of the test would be increased slightly if observers who discriminated the least between the slides were left out of the analysis.

The analysis of variance showed significant differences between groups and between slides (see Table 3), and also showed an interaction between the groups and the slides factors. The *F* ratio for the main effect of the four groups was 8.37 (p less than .001). The Forest Service showed the highest mean rating (4.92), followed closely

Table 3

Group Differences:

Analysis of Variance

Source	Degrees of Freedom	F Ratio
Groups	3	8.371***
Slides	35	34.192***
Groups X Slides	105	1.636***

Mean Group Ratings

USFS	4.92
PSYCH	4.89
BIKE	3.55
NRLAW	4.48

by the psychology class (4.89) and the law class (4.48). Bikecentennial showed the lowest mean rating, 3.55.

To further show group differences and interactions, each group's ratings of twenty-four slides were plotted according to the lowest-to-highest mean ratings of all four groups. Figure 5 shows that it is not possible to apply a simple transformation of the mean ratings which would eliminate or even substantially reduce differences between groups. If this were possible, the four curves in Figure 5 would be roughly parallel, or at least have similar slopes at any one point throughout the range of scores. The curves do not increase smoothly, however, so equalizing any two of them in part of their range would leave them unequal in the remainder. The curves also demonstrate the interaction between the groups and slides variables. The analysis of variance would show this interaction if it existed between any two of the four groups, but Figure 5 shows that all four groups have different relative ordering of the slides.

Group Agreement

If the raw preference scores are converted to rank orders, greater agreement between groups is apparent. Spearman rank-order correlation coefficients were computed for six pairings of the four groups. Twenty-four of the non-repeated slides from the latter thirty-six (the same

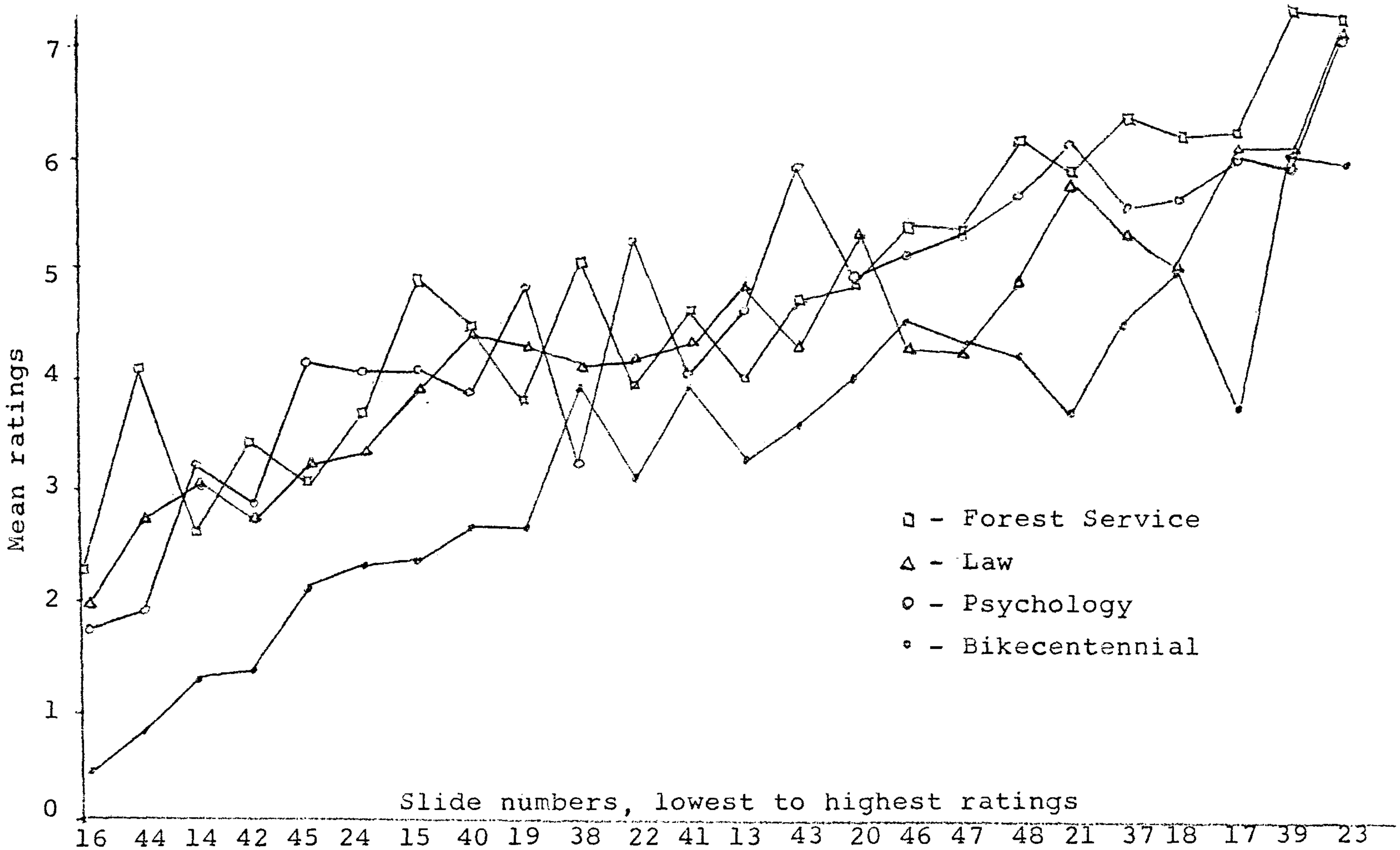


Figure 5

Preference Orders

as were used in Figure 5) were examined. In all cases, the probability that the agreement in rank orders of the scenes occurred by chance was less than one percent. The correlation coefficients ranged from 0.69 for the Forest Service-psychology pairing to 0.88 for the Forest Service -Bikecentennial pairing. Other rho values were 0.74 for psychology-Bikecentennial, 0.76 for law class-Bikecentennial, 0.73 for law class-psychology, and 0.81 for the law class-Forest Service pairing.

It is interesting to note that the two groups which differed the most in mean raw scores, Forest Service and Bikecentennial, showed the highest rank order correlation. The two groups differed considerably in their absolute judgements of the scenes, but agreed fairly well on the scenes' relative attractiveness. This shows that different observers may use the response scale differently, while still expressing similar preferences.

Repetition Study

Copies of ten of the first twelve slides were repeated in the final twelve slides. This allowed a test of each group's mean rating for the first and second showing of each member of the pairs. If the ratings of the pairs did not differ between the first and second showing, a repetition effect could be ruled out. A difference between the ratings would point to some sort of repetition effect, but would not necessarily identify the source.

Four matched-sample *t* tests were performed for the ratings of each of the ten slide pairings, one test for each observer group. The differences in ratings between the first and second members of the pairs significantly departed from zero only in the law class. The other three groups did not show significant differences for the ten pairs, taken as a whole. The mean difference scores were largest for the law class (0.55 rating point), and were smallest for Bikecentennial (0.07 point). The Forest Service showed the greatest single difference score for a slide pair, 1.31 points.

The law class showed a significant nonzero difference primarily because of a downward rating of the second member of the pairs. The other groups showed varying directions of preference for the second showing of the slide pairs.

Chapter 5

DISCUSSION

Validation Study

It is very likely that including developed foregrounds in the slides of cutting units lowered the preference ratings of the observers. This occurred despite clear instructions to the observers to ignore the foregrounds of the scenes in making preference judgements. The design of the rating method, with its use of line drawings and rapid slide presentation, was intended to minimize the effect of the foregrounds. The rapid rate of presentation probably did not prevent the observers from noticing the foregrounds. It was hoped that even if an observer formed a mental image of the foreground, it would not be processed to the extent of interfering with the formation and expression of an esthetic judgement.

The effect of the foregrounds was consistent in direction, which leaves the possibility that it could be accounted for in some way. The Forest Service group rated the foreground-absent condition about seven percent higher than the foreground-present condition. Bikecentennial showed a 14.5 percent change in the same direction, while the law class showed a six percent shift, much like the Forest Service. The psychology class showed a nonsignificant one percent shift in the same direction. Equal shifts could be accounted for, but these groups showed widely varying negative reactions to the developed foregrounds. It is not possible to predict, from this evidence, how other groups would react to similar scenes. It is reasonable to predict that other observers would prefer the scenes without developed foregrounds, but the degree of the shift could not be predicted with accuracy. This interaction of the foreground dimension with the different slides, as well as the interaction of order and distance with the foreground dimension, shows the difficulty of isolating the effect of developed foregrounds.

One goal of this study was to design a rating method which would not be susceptible to unpredictable or inconsistent effects of extraneous human development near the cutting unit under consideration. This study failed to validate one possible method, and has pointed out the need for a method which takes particular care to avoid the biasing effect of such human development.

Great care must be taken in the photographic representation of forest scenes in order to obtain a reliable assessment of scenic beauty. If a person wanted to compare the attractiveness of several kinds of logging methods, the photographs of the cutting units should have similar surroundings. There is at this time no proven method for obtaining esthetic judgements of a portion of a photograph which contains a single logging unit of interest. The remainder of the photograph influences observers' judgements, and in the case of logging or other development, the influence can be strong. It is therefore important to compose photographs used for evaluating scenes with special care for their entire image, not just for the logging unit in question.

Slope, aspect, and vegetation as well as human development could all contribute to a surroundings effect, so all of these elements should be as similar as possible in photographs of distant cutting units. This is difficult to achieve unless the units being compared are arrayed along a hillside having the same slope, aspect, and species composition. Uniform surroundings could be approximated by showing little more than the cutting unit alone. In the validation study, the technique of using a higher camera angle was sufficient to eliminate all of the developed foreground portions of the slides.

The distance of the cutting units and the order of presentation were the other variables evaluated in the validation study. The four groups did not show consistent results. The law class preferred the more distant units, while Bikecentennial and the psychology class showed the same tendency to a nonsignificant degree. The Forest Service rated the closer units slightly higher. One could speculate that the foresters liked the closer units because of their professional background, but this would be an unsupported *ad hoc* explanation.

In photographing cutting units for comparison, one can correct for different camera distances fairly well by using telephoto and zoom lenses. Photographing different scenes from different camera positions, however, is more difficult. In some cases a helicopter may be necessary to obtain similar vantage points if an unobstructed view from an appropriate hillside is not available.

For the repeated slides, order (first or second viewing) did not significantly affect preference ratings. The Forest Service group showed an interaction of order with distance and foreground, but did not show an effect of order alone. Since the distance and foreground dimensions interacted in some cases, photographs of logging units should not use different vantage points, and the camera distance and surroundings should be kept as constant as possible. This would reduce or eliminate the need to consider an order effect.

Intergroup Differences

The differences in preference ratings between the four groups can be explained in several ways. If scenic beauty is a single dimension, and the slides were judged solely on that dimension, the groups may have applied higher or lower criteria for each response category. If the criterion was stable over the duration of the experiment for each observer, one would expect the ratings to be shifted up or down relative to each individual and each group. The interaction of groups and slides argues against this effect. It is not likely that there is any simple, consistent way to transform the data (such as to _z_ scores) so that the groups show similar responses to each slide.

There are two possible conclusions to be drawn from the differences in the groups' mean ratings. The groups may, in fact, have different preferences in forest esthetics which were expressed as higher or lower ratings. Alternatively, the ratings may not have accurately expressed the observers' esthetic preferences, and therefore masked possible agreements between groups. This inaccuracy could come from the method of data analysis, in which case a different analysis could uncover agreements if they existed. The fairly good agreement in rank order of the slides, which was independent of the groups' mean ratings, shows the need for performing alternate analyses.

The good agreement between the groups in the rank orderings of the slides may mean that a rank order method of data collection is better. If the category scale used in this experiment yields nothing better than order information, one could obtain this information more directly with a rank order method. For large numbers of scenes, however, a numerical scale is easier to use.

<u>Repetition Effects</u>

Differences in observer responses to the same stimuli presented at the beginning and end of an experimental session are often ascribed to practice or fatigue. The ten paired slides which were included in the initial and final blocks of twelve slides failed to elicit a strong repetition effect. The law class, the only group to show a repetition effect, consistently preferred the first member of the pairs. It is reasonable to conclude that the experimental session was at least partially successful in avoiding practice or fatigue effects. The sessions were short, about twenty minutes, and the presentation of the slides only took seven minutes. A fatigue effect seems unlikely in this short a period, especially with stimuli which were more varied and contained more information than those typically used in psychophysical experiments. The judgement task required information processing both in the selection and expression of responses, and practice could have speeded up the responses. Faster response selection, however, would not seem to affect the kinds of responses selected.

The possibility remains that some observers may have changed their evaluation of a scene upon its second presentation for reasons unrelated to fatigue or practice. The nature of such an effect would not be clear, and its existence was not supported by the data.

Conclusions and Speculations

An esthetic preference assessment method would be most useful if it could be used to predict viewer reactions to forest management practices. To do this, one must generalize from results obtained by evaluating existing cutting units, roads, or other developments.

An evaluation can be made before a unit is cut, and at intervals afterward, to see how people's preferences change. This approach would minimize the problems of surroundings and distance which were identified in this study. The investigator would simply need to establish permanent photo locations and take photographs during similar seasonal, lighting, and atmospheric conditions. A long-term project could show how people regard the appearance of a cutting unit as it revegetates.

As public forest management policies change, new kinds of logging methods and sale designs are coming into use which scarcely resemble the large clearcuts of the last few decades. The newer methods can be compared with the old methods, but in most cases the differences are obvious and hardly need experimental verification. More useful would be a comparison between methods currently in use. Since many of the more advanced cutting methods, such as helicopter logging, long span skylines, and variously patterned and feathered shapes have not been used extensively in the Northern Rockies, there are few examples to compare in the field. This makes it difficult to select units having similar surroundings.

One goal in designing an esthetic assessment method is to make it simple to administer. While most Forest Service offices have access to computer facilities, these will not be used if the effort required to design a project is very great. The method used in this study, while having serious limitations, can be used by anyone who has access to a camera and a slide projector. Most of the effort in designing a study is needed in selecting photographs, not in setting up elaborate experiments. As few as two scenes can be compared, or as many as a hundred, without adding greatly to the length of an experimental session.

There are a great variety of forest types and landforms in the Northern Rockies, and it is unreasonable to expect a few research projects, however detailed, to determine the esthetic impacts of forest management throughout the whole region. For this reason, a simple research method which could be administered at a Ranger District or Forest level would complement more elaborate projects, and could be tailored to fit local needs. A forest manager could use such a method to decide between several logging methods for a particular sale area. The method evaluated in this study may meet the requirement of simplicity, and further testing may show that it gives useful information about people's esthetic preferences.

Chapter 6

SUMMARY

The nation's public forest lands are managed under a multiple-use principle in which all renewable forest resources are to be given equal consideration in determining land uses. Not all resource uses can be maximized on every acre of land, so it is important to know the effect of each resource use on competing uses. Timber production and scenic beauty are two important forest resources which frequently come into conflict. The purpose of this study was to develop and test a method for determining what effects timber harvesting and road construction have on the pleasing appearance of the forest.

Two approaches have been used by the U.S. Forest Service to assess the effects of forest management on the esthetic resource. One approach, based on landscape architecture theory, considers a forest scene as a combination of elements such as line, form, color, and texture, all of which vary in time and space. The position of an observer interacts with these features to determine how evident any management activities will be. The goal of a forest manager using this approach is to minimize disruption of the forest's appearance by careful design and location of management activities.

The second approach focuses on observers' reactions to forest scenes. By measuring verbal, numerical, or rank order comparisons of different scenes, the investigator obtains information about the existing or potential impact of forest management. People's reactions, not the landscape itself, are examined in this approach.

Both approaches to measuring management impacts are useful, and can be used in conjunction to help decide how to design a timber sale or a road to have a minimum adverse esthetic impact. Since the observer-response approach has been rarely used in forest planning, this study attempted to examine some possible problems in its use.

One method for assessing viewer reactions uses a zero -to-nine integer response scale to rate photographs of logging units. The observers use the ten point scale to express how much they like or dislike the appearance of a cutting unit in the photograph. The numerical responses can be transformed to correct for different uses of the response scale. When this is done, the responses of different groups of people from widely varying backgrounds tend to be similar. This method has been used to evaluate on-site views of cutting units, where most of the photograph shows the unit in question with little surrounding forest or scenery. Since many people view timber cutting units from a distance, it would be useful to extend this method to include off-site, or distant views of units.

Evaluating distant views encounters the problem of measuring the impact of a portion of a photograph which contains the cutting unit in question, while controlling for the influence of the surroundings. Suitable instructions to the observers and a special experimental technique may reduce the effect of extraneous surroundings to an insignificant degree. If surroundings have a significant and unpredictable effect on the observers' responses, despite the experimental precautions, the usefulness of the method would be reduced.

The esthetic assessment method tested in this study used line drawings of the photographic slides with a dotted-line enclosure to mark the cutting unit being evaluated. Observers were instructed to evaluate only the cutting unit shown by the dotted line, which was printed next to each slide's response scale.

Three possible confounding effects were examined: the presence of human developments such as roads and other logging units in the foregrounds of the photographs, the distance of the units from the camera, and the order of presentation of the two levels of each of the above factors. Three replications of the resulting 2x2x2 factorial design were shown, giving twenty-four slides in the central portion of the experiment. An additional twenty-four slides were shown, half before and half after the factorial design, to test for repetition effects. The slides were shown to four groups of observers representing different interests and educational levels. One group consisted of Forest Service employees, one group worked with a citizen environmental group, and two groups were students in upper and lower division university classes.

The assessment method was shown to be affected by some of the possible confounding factors. Three of the four groups preferred the slides which did not have developed foregrounds, while one group showed no preference. None of the groups preferred the first or second viewing of a scene over the other. One group preferred distant over close views, although the other groups showed no effect. One group showed an interaction of the foreground and distance factors, which could be explained by the relative influence of a developed foreground in front of a distant unit as compared to a closer unit.

The groups differed in their ratings of individual slides, showing different uses of the response scale which could not be eliminated by simple data transformations such as to z scores. The rank orders of each group's mean ratings for each slide, however, showed substantial agreement between groups on what were the most liked and least liked scenes. A practice or repetition effect was found for only one group. This group preferred the first showing of the identical slide pairs shown in the first and last quarters of the experiment.

The study showed that the method used to obtain preference judgements of offsite views of logging units is subject to several confounding effects. The strongest of these was the effect of developed foregrounds in lowering the ratings of cutting units in the middleground of a slide. The method may still give useful information about the esthetic impact of logging or other forest practices, but to be reliable it must control for confounding effects. One possible control would be to show slides with as uniform surroundings as possible, at uniform distances from the photographer. This would increase the difficulty of taking photographs which represent the scenes in question. It appears, however, that such precautions are necessary to obtain observer judgements which are reasonably free of confounding effects.

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APPENDIX A

Slide Descriptions

Slide No.	Location	Treatment	Timber Type
1	Rigdon R.D.	clearcut	Douglas fir
2	Wise River	none	Lodgepole pine
3	Rigdon	partial cut	Douglas fir
4	Rigdon	clearcut	Douglas fir
5	Wisdom	clearcut	Lodgepole pine
6	Verlot	clearcut	Douglas fir
7	Tally Lake	clearcut	Douglas fir
8	Sula	partial cut	Yellow pine
9	Rigdon	clearcut	Douglas fir
10	Rigdon	clearcut	Douglas fir
11	Tally Lake	clearcut	Douglas fir
12	Swan Lake	burn	Douglas fir
13	Swan Lake	clearcut	Douglas fir
14	Tally Lake	clearcut	Douglas fir
15	Wisdom	clearcut	Lodgepole pine
16	Wisdom	clearcut	Lodgepole pine
17	Sula	clearcut	Douglas fir
18	Tally Lake	partial cut	Douglas fir
19	Tally Lake	clearcut	Douglas fir
20	Tally Lake	partial cut	Douglas fir

Note: Treatments are logging methods which include various specific methods under each category.

Timber Type is the dominant stand composition.

Location gives the Ranger District name:
-Rigdon R.D., Willamette National Forest, Oregon;
-Wisdom and Wise River, Beaverhead N.F., Montana;
-Verlot, Mt. Baker N.F., Washington;
-Sula and West Fork, Bitterroot N.F., Montana.

APPENDIX A (continued)

Slide No.	Location	Treatment	Timber Type
21	Sula R.D.	clearcut	Douglas fir
22	Sula	clearcut	Douglas fir
23	Sula	partial cut	Yellow pine
24	Tally Lake	clearcut	Douglas fir
25	Swan Lake	clearcut	Douglas fir
26	Wisdom	clearcut	Lodgepole pine
27	Wisdom	clearcut	Lodgepole pine
28	Tally Lake	partial cut	Douglas fir
29	Tally Lake	clearcut	Douglas fir
30	Tally Lake	clearcut	Douglas fir
31	Sula	clearcut	Douglas fir
32	Tally Lake	clearcut	Douglas fir
33	Sula	clearcut	Douglas fir
34	Tally Lake	clearcut	Douglas fir
35	Sula	clearcut	Douglas fir
36	Sula	partial cut	Yellow pine
37	Wisdom	none	Lodgepole pine
38	Rigdon	partial cut	Douglas fir
39	Sula	partial cut	Yellow pine
40	Rigdon	clearcut	Douglas fir
41	Swan Lake	burn	Douglas fir
42	Tally Lake	clearcut	Douglas fir
43	Verlot	clearcut	Douglas fir
44	Wisdom	clearcut	Lodgepole pine
45	West Fork	clearcut	Douglas fir
46	Rigdon	clearcut	Douglas fir
47	Rigdon	clearcut	Douglas fir
48	Tally Lake	clearcut	Douglas fir

APPENDIX B

Sample Instructions

My name is Fred Swanson. I am working on a research project concerning the evaluation of forest scenes. This session will take about fifteen minutes of your time. Afterwards, I would be happy to answer any questions you may have about the nature of this experiment. In order to avoid introducing possible biases into the experiment, I will read you a set of standardized instructions, which describe how the experiment works.

We are interested in your observations of some timber cutting practices. We want to know what you like and what you dislike in a forest scene. As each slide is shown to you, we want you to judge on a 0 - 9 scale how much you like or dislike the appearance of the timber harvest in the slide. Some slides also show other logging areas and attractive scenery which we want you to ignore.

To identify the cutting unit we want you to evaluate, we have made line drawings of each slide, with the area we want you to evaluate outlined by a bold, dotted box. The approximate area enclosed by the dotted line is the only portion of the slide we want you to evaluate. When each slide is shown, look at the line drawing briefly and then look at the screen, focusing on the area of the slide which is indicated by the line.

Some slides do not show evident logging activities; we still want you to evaluate the portion of the slide shown in the box.

Decide how much you like or dislike the appearance of the unit within the dotted line by circling an appropriate number on the scale below the drawing. A 0 would mean that you strongly dislike the unit, while a 9 would indicate strong liking. A 3 would mean that you somewhat dislike the unit, while a 6 would indicate some liking for the unit. A 4 or a 5 would indicate very little liking or disliking of the unit.

Do not circle the words "like" or "dislike" on your response sheet. These are printed only to show you which way the response scale works. Also, circle only one of the integers shown- do not circle two numbers or circle between numbers.

In all, forty-eight slides will be shown. As each slide is shown, I will call out its number. Notice that the slides run from left to right down each page, and are printed on both sides of each sheet. You will have eight seconds to view each slide. This is sufficient time to make an esthetic judgement. We repeat that we are interested only in the appearance of a single logging unit in the slide. We are not interested in the type of logging done or in the silvicultural aspects of the units. We want to know whether you think the unit looks good or bad on an esthetic basis only.

Are there any questions? (Answer clarification questions only).

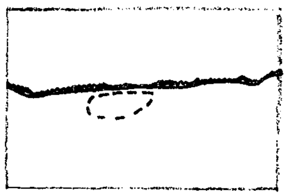
Please mark today's date, (give date), on top of your response sheet, along with (group identification) to identify your group.

APPENDIX C

Sample Response Sheet

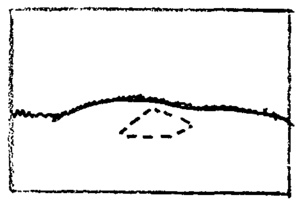
(Reduced)

17



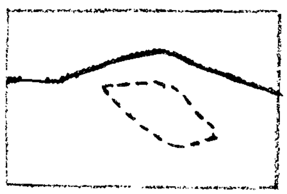
dislike 0 1 2 3 4 5 6 7 8 9 like

18



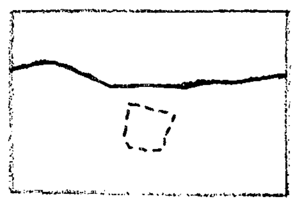
dislike 0 1 2 3 4 5 6 7 8 9 like

19



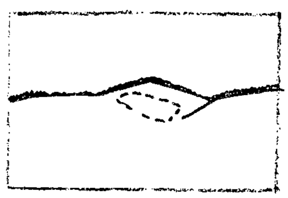
dislike 0 1 2 3 4 5 6 7 8 9 like

20



dislike 0 1 2 3 4 5 6 7 8 9 like

21

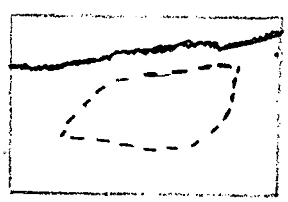


dislike 0 1 2 3 4 5 6 7 8 9 like

22

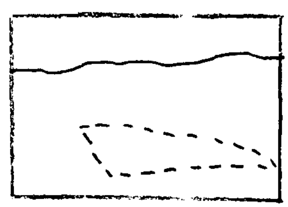
dislike 0 1 2 3 4 5 6 7 8 9 like

23



dislike 0 1 2 3 4 5 6 7 8 9 like

24



dislike 0 1 2 3 4 5 6 7 8 9 like